

Remarks and Arguments

Claims 1-11 and 44-54 were presented for examination. Claims 1, 5, 7, 9-11, 44, 48, 50 and 52-54 have been amended.

Claims 1 and 44 have been amended to clarify the relationship of the data, the data identifier and the location where the data is stored. These changes are based on a discussion between applicants' attorney and the examiner during telephone conferences on November 11-13, 2009.

Claims 5, 7, 9-11, 48, 50 and 52-54 have been amended in order to correct a minor antecedent problem and to conform the claim language to that used in the independent claims. In independent claims 1 and 44, the term "resources" was changed to "storage devices". Claims 5, 7, 9-11, 48, 50 and 52-54 have been amended to change the corresponding terms "resources" to "storage devices" in order to conform the dependent claims to changes made in the independent claims.

Claims 1-11 and 44-54 have been rejected under 35 U.S.C. 103(a) as obvious over U.S. Patent No. 6,195,703 (Blumenau, previously cited) in view of U.S. Patent No. 5,909,686 (Muller.) The examiner comments that the Blumenau reference discloses all of the recited claim limitations with the exception that it does not disclose a switch fabric for temporarily connecting an access interface module to a selected subset of storage devices so that data can be transferred to the selected subset of storage devices. However, the examiner asserts that such a switch fabric is taught by Muller and contends that it would have been obvious to combine the teachings of Blumenau and Muller to make use of the switch fabric low-level instructions for accessing the switch forwarding database.

The examiner refers to column 2, lines 5-12 of the Blumenau reference. There the reference discloses a storage system in which a host can send a request to access storage resources through a switch to one of a plurality of network ports of a data storage subsystem. The switch allows paths to be selected between a particular host and alternative storage subsystem ports based on load balancing considerations. However, once a request arrives at any network port of the storage subsystem a data address in the request is translated to a physical location on one of the storage devices and the data is written to, or read from, that storage device. For example, Blumenau, column 4, lines 43-53, discloses:

"If the data to be accessed resides in the cache memory, then the port adapter accesses the data in the cache memory. If the data to be accessed does not reside in the cache memory, then the port adapter forwards a storage access request to the storage adapters 37, 38. One of the storage adapters 37, 38 responds to the storage access request by performing a logical-to-physical translation to determine where the data to be accessed resides on the storage devices, and reads the data from the storage devices and writes the data to the cache memory, for access by the port adapter." (emphasis added)

This section clearly indicates that the physical storage location depends on the data address and not on load balancing considerations. Further sections of Blumenau reinforce this section. For example, the examiner contends that column 12, lines 26-33 of Blumenau disclose a data storage request that includes a data identifier. However, this section of Blumenau actually discusses the contents of entries in a routing table that controls the switch. As stated there, each entry include a list pointer for the host, a storage port list for the host, a host name, a world-wide name for the host, and a source address (S_ID) for the host. All of this information refers to the host, not to data.

Consequently, although data access requests can be routed along different paths between a host and the data storage subsystem, there is no teaching or suggestion in Blumenau that the data to which the requests refer could be stored in different storage devices based on load balancing considerations.

The Muller reference discloses a modular store and forward data packet switch in which data packets received at input ports are temporarily stored and then selectively forwarded to switch output ports based on forwarding information in a forwarding database. The switch modules can be connected together to produce a switch network that can transmit Internet or Ethernet data packets and the forwarding information allows data packets to be routed through the switch over a plurality of routes based on any one of a number of forwarding algorithms. The bulk of the Muller disclosure is directed to switch fabric hardware that allows a CPU to efficiently interact with and

manage the information in the forwarding database as the switch operates. However, when the Muller switching system is viewed end-to-end, it is clear that the Muller switch network is deterministic; that is, a data packet is directed from an input end node to an output end node based on the address information in the packet header. Therefore, the teachings of Muller are similar to those of Blumenau: that data can be routed along different paths between an input node and an output node selected by the data address. There is no teaching or suggestion in Muller that data at an input node could be directed to different output nodes based on criteria other than the data address, such as load balancing considerations.

It would certainly be possible to combine the teachings of Blumenau and Muller. For example, the Muller switch could be used as the 32-port switch 40 disclosed in Blumenau. However, since neither of the cited references discloses a system in which data corresponding to the same data identifier or address may be stored in different physical storage device locations based on criteria, such as load balancing or availability and, consequently, the combination of these references cannot teach or suggest this type of operation.

The examiner contends “One [of] ordinary skill in the art at the time of the invention knows that ‘routing information based on the loading characteristic of the storage access request received at the switch inputs in order to balance loading of the storage access requests upon the outputs of the switch’ is prime example of load balancing, where the routing information is based on the loading characteristic of the meaning workload of the memory.” While applicants do not disagree with this contention, it is not what is being claimed. The claims are concerned with where the data is stored not how the data arrives there. For example, claim 1 (and claim 44 which has similar wording) recites:

“...an access interface module which receives from the client data storage requests, each including a data object to be stored and a data object identifier that identifies that data object and, in response to each service request and based on a workload and on relative demands placed on subsets of the plurality of storage devices instead of a physical location in

the plurality of storage devices, dynamically selects a subset of the plurality of storage devices in which the data is stored so that data corresponding to the same data object identifier can be transferred to different physical storage device locations from request to request in order to dynamically distribute the workload across the plurality of storage devices.”

This claim wording does not read onto the Blumenau/Muller combination even if the entire Blumenau storage subsystem is considered to be a storage “device” because, under this interpretation, it would not be possible to select a subset of a plurality of storage devices as recited. It is also clear that, while the Blumenau/Muller system can alleviate overloading of the data storage subsystem network ports it cannot accomplish the objectives of the invention as set forth above. Accordingly, claims 1 and 44 patentably distinguish over the cited reference combination.

Claims 2-11 and 45-54 are dependent, either directly or indirectly, on claims 1 and 44, respectively, and incorporate the limitations thereof. Therefore, they also distinguish over the cited reference combination in the same manner as claims 1 and 44. In addition, these claims recite further elements not disclosed or suggested by the cited reference combination.

Claims 2 and 45 recite that the access interface module selects the subset of the plurality of resources based on the relative demand placed on the subset of resources. Claims 1 and 44, from which these claims depend, indicate that this resource subset is where the data is stored. As noted above, neither Blumenau nor Muller disclose any arrangement where the data storage location is defined by anything other than the data address. The examiner cites Muller, column 1, lines 49-63 as disclosing this recited element, but this section of Muller discusses problems that occur when the central processing unit interacts directly with the forwarding database.

Claims 3, 4, 5, 6, 46, 47, 48 and 49 recite details of the switch fabric that connects the access interface modules and the storage devices. These details include that the switch comprises separate control and data switch fabrics that are optimized for control and data signals, respectively; that the data is transmitted only through the data

switch and that the data switch comprises a crosspoint switch and the control switch comprises an Ethernet switch. While it is clear that the Blumenau switch must switch both data requests and the data to which they refer, the switch itself is only shown as a single block (40) with no indication that two separate switches are used. The examiner refers to Blumenau, column 2, lines 7-19. However, this section of Blumenau discusses how data and requests are routed between switch inputs and switch outputs; no internal switch details are provided. Therefore, the elements recited in claims 3 and 46 are not disclosed in Blumenau. Muller also discloses no switch analogous to the recitation of these claims.

Claims 7 and 50 further recite a resource module connected to the plurality of resources that generates preallocation information that preallocates storage from the plurality of resources in order to evenly distribute a workload across the plurality of resources. As discussed above, Blumenau and Muller determine where data will be stored based on the data address; no preallocation is necessary or discussed. The examiner cites Blumenau, column 2, lines 5-21. This section of Blumenau discusses routing of data requests and, accordingly, no preallocation of any storage is discussed.

Claims 8 and 51 recite that the preallocation information is transferred to the access interface module through the switch. The examiner cites Muller, column 4, lines 44-57. This section of Muller discusses the three switch interfaces (205, 215 and 225) through which data packets enter and leave the switch. However, the preallocation information is recited in parent claims 7 and 49 as information that that preallocates storage from the plurality of resources in order to evenly distribute a workload across the plurality of resources. There is no indication that the data to which Muller refers preallocates storage and, consequently, that data is not analogous to the recited preallocation information.

Claims 9 and 52 recite that an access interface module selects a subset of the plurality of resources based on the preallocation information. As mentioned previously, the Blumenau and Muller references store data in storage devices at location that are determined by addresses, not preallocation information. Therefore, these claims also distinguish over the cited reference combination.

In light of the forgoing amendments and remarks, this application is now believed in condition for allowance and a notice of allowance is earnestly solicited. If the examiner has any further questions regarding this amendment, he is invited to call applicants' attorney at the number listed below. The examiner is hereby authorized to charge any fees or direct any payment under 37 C.F.R. §§1.17, 1.16 to Deposit Account number 50-3969.

Respectfully submitted

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